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Off the grid low-rank matrix recovery

Abstract

Matrix sensing problems capitalize on the assumption that a data matrix of interest is low-rank or it can be well-approximated by a low-rank matrix. This low dimensional structure sometimes arises because the data matrix is obtained by sampling a "smooth" function on a regular (or structured) grid. However, in many practical situations the measurements are taken on an irregular grid (that is accurately known). This results in what we call an "unstructured data matrix" that is a worse fit for the low rank model compared to its regular counterpart and results in degraded reconstruction via rank penalization techniques. In this talk, we propose a modified low-rank matrix recovery work-flow that admits unstructured observations. Specifically, we incorporate into the nuclear-norm minimization problem a regularization operator that (sufficiently accurately) maps structured data to unstructured data. As a result, we are able to compensate for data irregularity. We establish recovery error bounds for our method. Furthermore, we will present numerical experiments, both in the matrix sensing and matrix completion settings, including applications to seismic trace interpolation to demonstrate the potential of the approach.

This is joint work with Oscar Lopez, Rajiv Kumar, and Felix Herrmann.

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